

SPECIES COMPOSITION, SEASONAL VARIATION, SEX RATIO AND BODY LENGTH OF SMALL CETACEANS CAUGHT OFF WEST, SOUTH-WEST AND SOUTH COAST OF SRI LANKA¹

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(With three text-figures)

Key words: species composition, seasonal variation, sex ratio, cetaceans

The present study on small cetacean catches in Sri Lanka was undertaken in an attempt to fill at least some of the many gaps in the knowledge regarding the interaction between small cetaceans and the fisheries industry in Sri Lanka. The study concentrated on data from four selected sites on the west, southwest, south coasts of Sri Lanka and species composition, seasonal trends, sex ratios and size categories occurring in the catch are discussed. The study recorded a total of 14 species in the catch and found *Stenella longirostris* to be the most abundantly caught species at all sites. Contrary to the results of previous short term studies, the post-monsoonal period from the end of August to November was the season when peak catches were recorded at all sites selected for data collection. Sex composition and length frequency distribution were comparatively analysed for the four major species in the catch, bringing out certain interesting trends which may be a cause for concern. The practice of deliberate harpooning was found to account for a sizable proportion of the small cetacean catch while the practice itself seems to be spreading to new areas.

INTRODUCTION

Very little information is available on the species composition of small cetaceans around Sri Lanka although they inhabit these waters. The first known record of a cetacean in Sri Lanka was by Emerson Tennent (1859). Dolphins had been hunted and eaten by local populations since early days. Nevill (1887), reports of a dolphin fishery that existed in Ceylon in the late 1880's. Recent studies on the accidental take of small cetaceans around Sri Lanka are limited to short term studies at a few fish landing sites along the west and east coasts. Prematunga *et al* (1985), concentrated on the landed catch at Trincomalee on the east coast and recorded 11 species, having examined 398 specimens. Joseph *et al.* (1983) undertook a four month study at the Negombo fish landing site on the west coast

and recorded 5 species, having examined 33 specimens. Alling (1985b) examined the catch at three landing sites, namely Beruwala (west coast), Valaichenai and Trincomalee (east coast), recorded 11 species and estimated nearly 40,000 small cetaceans being landed in Sri Lanka's fishery annually. Joseph and Siddeek (1985) recorded 11 species from the catch at Beruwala and Negombo (west coast) and estimated an annual catch rate of only 9,129 small cetaceans in Sri Lanka. Leatherwood (1986) and Leatherwood and Reeves (1989) report on all aspects of small cetaceans in Sri Lanka, including historical data, sightings at sea, stranding and observations at fish landing sites and markets all around the island.

Though only preliminary figures are available, it is evident that the accidental by-catch of small cetaceans has been increasing since the mechanisation of the fishing fleet and the introduction of synthetic gillnets in the late 1960's.

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MATERIAL AND METHODS

From May 1985 to December 1988, four commercial fish landing sites, namely Negombo, Beruwala, Mirissa and Kottegoda were visited once a fortnight and the species composition of small cetaceans in fishing boats was sampled. Species were identified based on Watson (1981) and Leatherwood and Reeves (1983). Species composition, total body length and sex were recorded. Further, the number of small cetaceans killed by harpooning was also noted by observing harpoon marks on the animals. The area of gillnetting and harpooning was recorded by questioning the fishermen. The stretched mesh size of the gillnets, the number of pieces in each net, their height, number of hours spent fishing etc. were also recorded.

In Sri Lanka a variety of boats ranging from 510 cm fibreglass boats with outboard engines to fully mechanised 780 - 960 cm boats operate, to fish for pelagic species such as tuna, shark, marlin and skipjack, using gillnets (stretched mesh size 125 mm), pole and lines, long lines and trolling. Hand held harpoons are used in some areas for direct take, of small cetaceans from mechanised boats.

RESULTS

Species Composition

Fourteen species were identified from the four landing sites (Table 1). *Stenella longirostris* was the dominant species in the catch at all sampling stations. The maximum number of species recorded at a station was 11, for both Negombo and Mirissa, and the minimum was 7 at Kottegoda.

Stenella longirostris constituted 51.4% of the total recorded catch at all stations together and *S. coeruleoalba* 13.9%, *Tursiops truncatus* 9.3%, *S. attenuata* 9.0%, *Grampus griseus* 5.5%, *Peponocephala electra* 4.1%, respectively. Each of the remaining 8 species constituted less than 2.0%.

TABLE 1
NUMBER OF SPECIMENS RECORDED FOR EACH SPECIES

Species	St.1	St.2	St.3	St.4	Total	%
<i>Stenella longirostris</i> (Spinner Dolphin)	39	75	55	19	188	51.4%
<i>Stenella coeruleoalba</i> (Striped Dolphin)	7	22	10	12	51	13.9%
<i>Tursiops truncatus</i> (Bottle-nose Dolphin)	8	9	17	—	34	9.3%
<i>Stenella attenuata</i> (Spotted Dolphin)	5	7	19	2	33	9.0%
<i>Grampus griseus</i> (Risso's Dolphin)	4	10	4	2	20	5.5%
<i>Peponocephala electra</i> (Melon-headed Whale)	7	5	2	1	15	4.1%
<i>Kogia simus</i> (Dwarf Sperm Whale)	2	2	—	1	5	1.4%
<i>Steno bredanensis</i> (Rough-toothed Dolphin)	2	1	2	—	5	1.4%
<i>Lagenodelphis hosei</i> (Fraser's Dolphin)	1	—	3	—	4	1.1%
<i>Feresa attenuata</i> (Pygmy Killer Whale)	—	1	2	1	4	1.1%
<i>Pseudorca crassidens</i> (False Killer Whale)	—	1	2	—	3	0.8%
<i>Delphinus delphis</i> (Common Dolphin)	—	—	2	—	2	0.5%
<i>Kogia breviceps</i> (Pygmy Sperm Whale)	1	—	—	—	1	0.3%
<i>Orcinus orca</i> (Killer Whale)	1	—	—	—	1	0.3%

* St.1=Negombo St.2=Beruwala St.3=Mirissa St.4=Kottegoda

Seasonal Variation

The seasonal distribution of catches, according to station, is shown in Fig. 1. Negombo showed year round catches with zero catch only in June and a catch peak in October. Two sub-

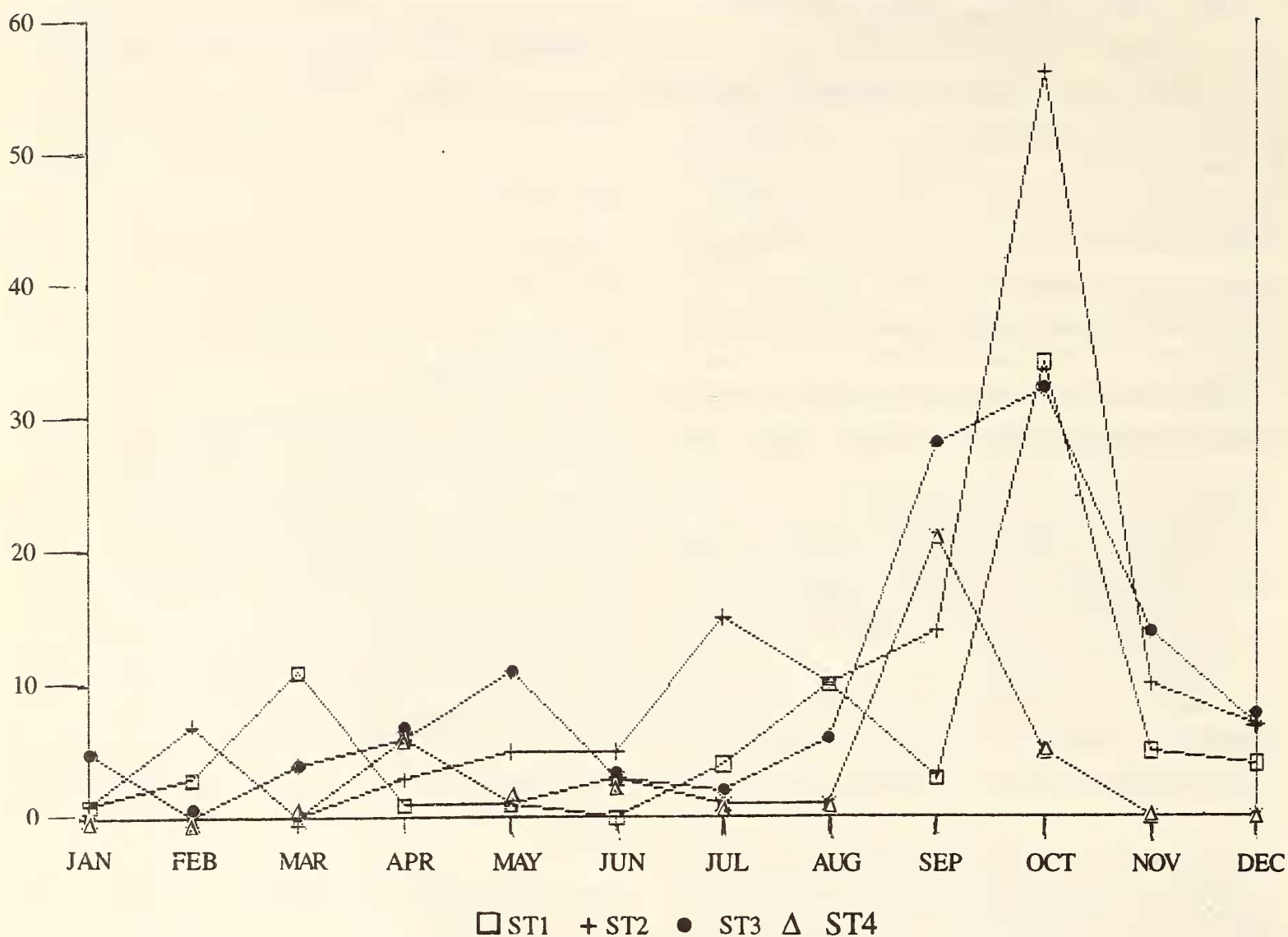


Fig. 1. Seasonal distribution by stations

peaks were seen in March and August. Beruwala also had year round catches, with a zero catch in March, a sub-peak in July and the maximum catch in October. Mirissa had zero catch in February and a sharp increase in numbers caught in September, reaching a peak in October. These three stations showed a definite peak in catches in October, dropping sharply in November. Kottegoda differed from this pattern as catches were recorded only in the period from April to October with zero catches in the other five months of each year. The maximum catch for this station was in September, with declining numbers in October.

The seasonal variation of the catch for the four major species, namely *Stenella longirostris*, *S. coeruleoalba*, *S. attenuata* and *Tursiops*

truncatus is shown according to season for the total catch in Fig. 2. All four species had peak catches in the post-monsoon season from September to December and smaller numbers at other times of the year. *Stenella longirostris* and *Tursiops truncatus* were caught in larger numbers during the monsoon season from May to August than in the pre-monsoon season between January and April. However, there was no difference in the catch rates of *Stenella coeruleoalba* and *S. attenuata* between the pre-monsoon and monsoon seasons. There was a slight variation from the general pattern at Kottegoda for *Stenella coeruleoalba*, which had a peak catch in the pre-monsoon season with large numbers being landed in April and a smaller peak in the post-monsoon season in October, which was the peak at other stations.

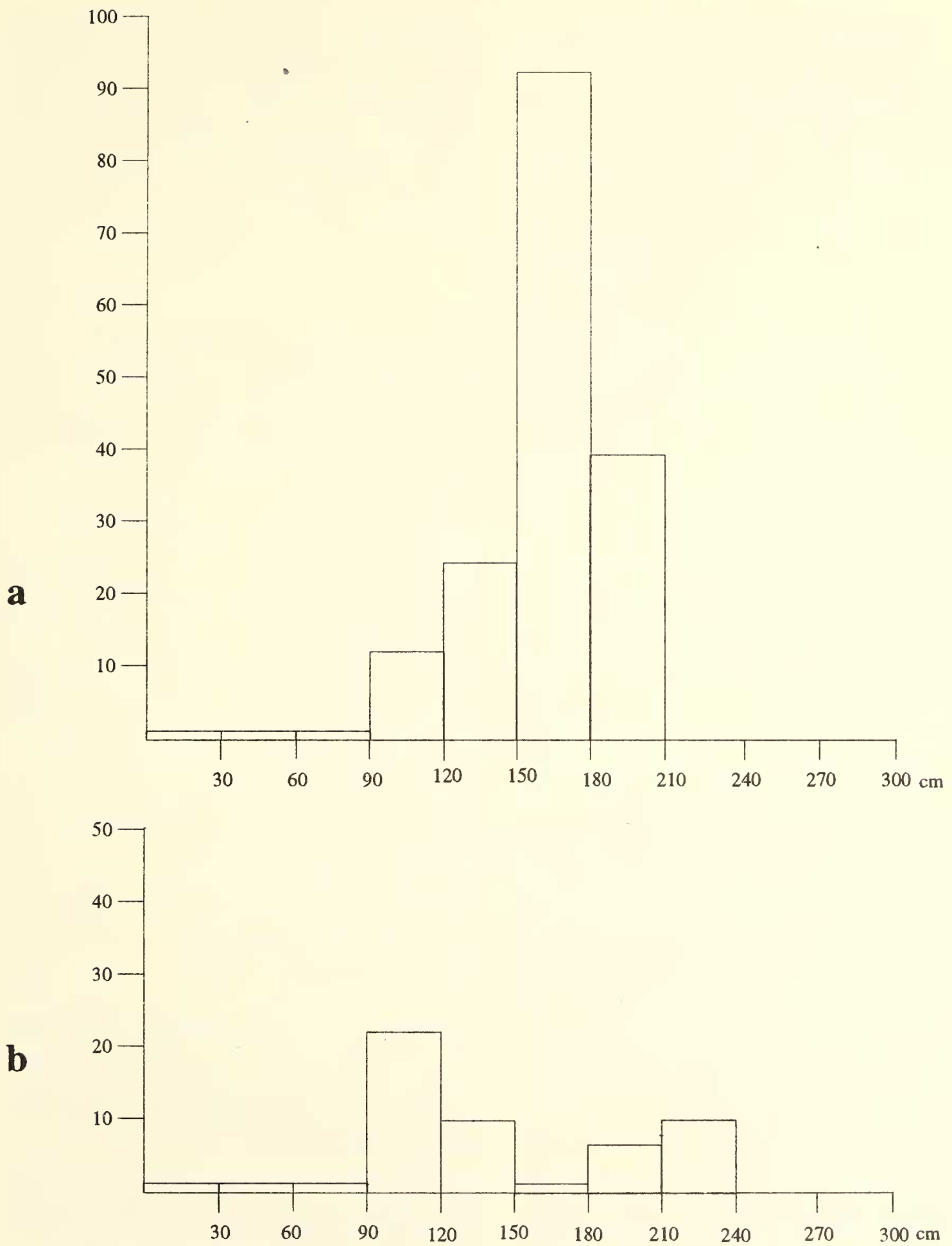


Fig. 2. Length frequency distribution range (of 4 major species)
 a: *Stenella longirostris*; b: *S. coeruleoalba*

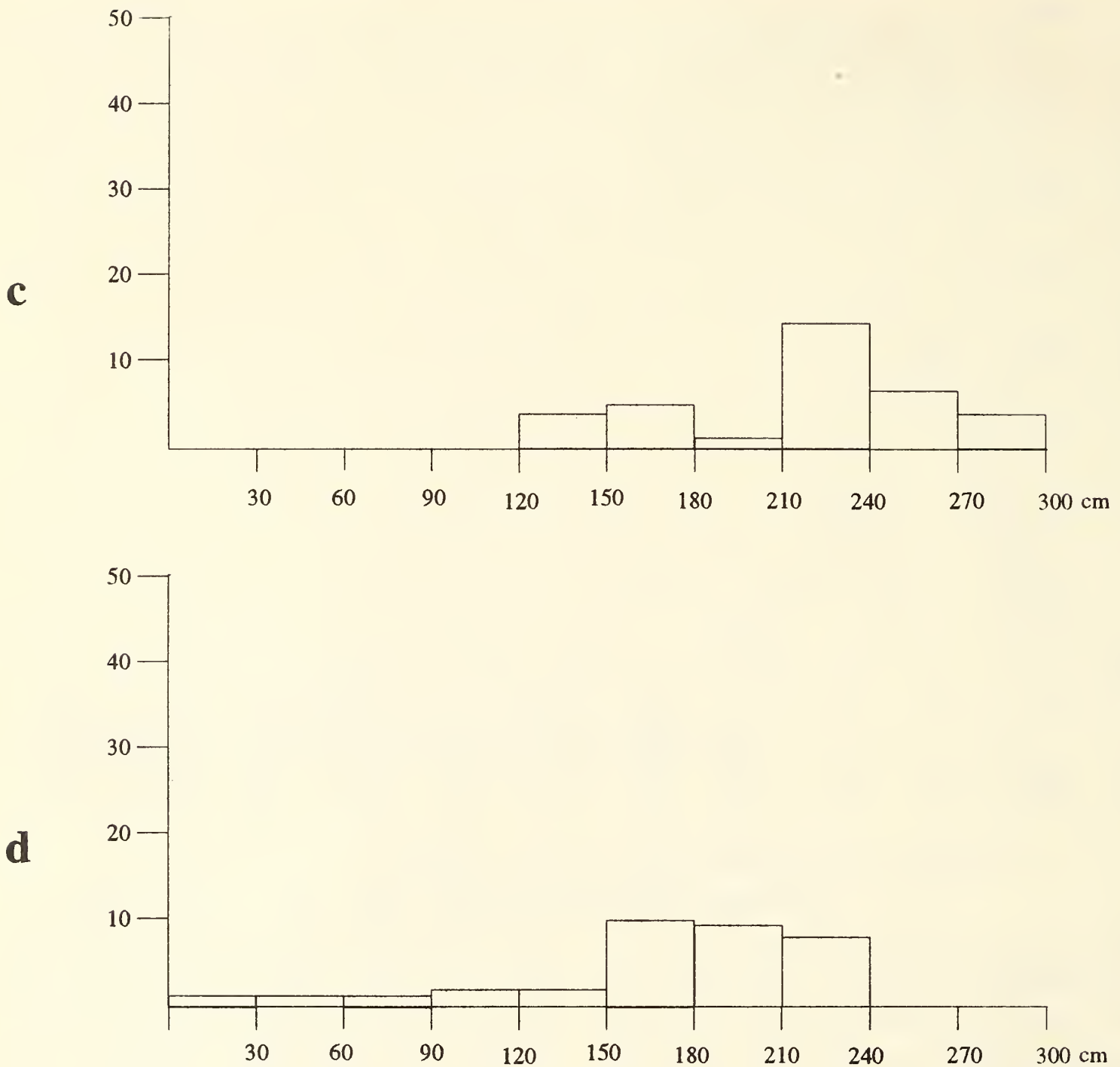


Fig. 2 contd. Length frequency distribution range (of 4 major species)

c: *Tursiops truncatus*; d: *Stenella attenuata*

Sex Ratio

The sex ratio of the catch for each species and each station is given in Table 2. For all species together, the catch at Negombo consisted of an equal number of males and females. At Beruwala and Kottegoda a larger number of males were caught while at Mirissa a larger number of females were caught. A significantly larger number of *Stenella longirostris* males were caught at Beruwala and Kottegoda, while at Negombo also more males were caught but the difference

between the sexes was less significant. Of the total 366 specimens, 197 males and 159 females were recorded while 10 were unidentified, comprising a frequency of 53.8% males, 43.4% females and 2.7% unidentified.

For *Stenella longirostris* the largest percentage of both males and females caught came in the range of 150 - 179.9 cm and from 90 - 119.9 cm for *S. coeruleoalba*. In *Tursiops truncatus* most males caught measured 150.0 - 179.0 cm, and 210 - 239.9 cm, but most females

caught measured 210 - 239.9 cm. Females of *Stenella attenuata* were caught in high numbers in the 150 - 179.9 cm range and the males in the 180 - 209.9 cm range, with fairly high numbers between 150 - 179.9 cm, and 210 - 239.9 cm. Only 3, females of the four dominant species measured less than 90 cm. The only catch larger than 240 cm was *Tursiops truncatus*, the majority of which were females.

Body Length

The body length of *Stenella longirostris* ranged from 86.25 to 197.50 cm (SD=22.08), *Stenella coeruleoalba* from 86.25 to 228.12 cm (SD=49.43), *Tursiops truncatus* from 120.00 to 278.75 cm (SD=44.22) and *Stenella attenuata* ranged from 86.25 to 225.00 cm. (SD=37.97).

The frequency distribution of *Stenella longirostris* was similar for Negombo, Beruwala and Mirissa, but all specimens recorded at Kottegoda were above 120 cm in length, ranging upto 210 cm. The frequency distribution for *Stenella coeruleoalba* was similar for all four stations. A high percentage of specimens at all stations come within the 90 - 119.9 cm range, indicating that a large number of juveniles are caught. *Tursiops truncatus* had a similar frequency distribution at Negombo and Beruwala. At Mirissa all specimens were above 180 cm indicating that only adult animals were caught at this station. This species was not recorded at Kottegoda during the study period. The sample size for *Stenella attenuata* was not adequate to comment on frequency distribution.

Capture Methods

The capture methods resulting in the mortality of small cetaceans in Sri Lanka are shown according to station in Table 3. Negombo and Mirissa practise direct harpooning in addition to accidental gillnet entrapment. All small cetaceans recorded at Beruwala and Kottegoda were accidental bycatch of the gillnet fishery. At Mirissa more small cetaceans were caught by

TABLE 2
SEX RATIO BY SPECIES AND STATION

Species	St.1		St.2		St.3		St.4	
	M	F	M	F	M	F	M	F
<i>Stenella longirostris</i>	21	18	53	18	24	31	15	4
<i>Stenella coeruleoalba</i>	5	2	12	9	6	4	5	7
<i>Tursiops truncatus</i>	2	5	4	5	6	11	-	-
<i>Stenella attenuata</i>	2	1	5	2	9	10	2	-
<i>Grampus griseus</i>	2	2	6	4	2	2	2	-
<i>Peponocephala electra</i>	2	5	3	2	1	1	-	1
<i>Kogia simus</i>	-	-	1	1	-	-	-	1
<i>Steno bredanensis</i>	1	1	1	-	1	1	-	-
<i>Lagenodelphis hosei</i>	1	-	-	-	-	3	-	-
<i>Feresea attenuata</i>	-	-	-	1	1	1	-	1
<i>Pseudorca crassidens</i>	-	-	-	1	2	-	-	-
<i>Delphinus delphis</i>	-	-	-	-	-	2	-	-
<i>Kogia breviceps</i>	-	1	-	-	-	-	-	-
<i>Orcinus orca</i>	-	1	-	-	-	-	-	-
Total	36	36	85	43	52	66	24	14

*St.1=Negombo St.2=Beruwala St.3=Mirissa St.4=Kottegoda

direct harpooning than as bycatch, and *viceversa* at Negombo. Of the total of 366 specimens recorded from all four stations, 69.1% was bycatch in gillnet fishery while 30.9% was by harpooning.

Area of Operation

The area of operation of mechanised boats (780 - 960 cm) engaged in gillnet operations in all sampling stations was approximately 55 to 60 km offshore. Therefore, the area in which small cetaceans are killed as a result of accidental bycatch is an approximately 15 km wide belt off the west and southwest coast as shown in Fig. 3. Direct harpooning, on the other hand, could be done anywhere between the shorelines and 60 km offshore when small cetaceans are sighted and weather conditions are favourable.

DISCUSSION

The present paper has identified 14 species in the total recorded catch, two of which (*Peponocephala electra* and *Orcinus orca*) have not been recorded before. De Silva (1987) reports of a *Peponocephala electra* skull in the Calicut

TABLE 3
CAPTURE METHOD BY STATION

Station	Bycatch		Harpooned	
	No.	%	No.	%
Negombo	43	55.8%	34	44.2%
Beruwala	133	100.0%	0	-
Mirissa	39	33.1%	79	66.9%
Kottegoda	38	100.0%	0	-
Total	253	69.1%	113	30.9%

museum and sight records of *Orcinus orca* off southern Sri Lanka in the 19th century. I found that *Peponocephala electra* was among the six most frequently caught species in the catch, comprising 4.0% of the total recorded catch. *Orcinus orca* was recorded only once during the present study when a 277.5 cm long female specimen was landed as bycatch at Negombo on 8th April, 1986. Joseph *et al.* (1983), Joseph and Siddeek (1985) recorded *Orcella brevirostris* as one of the dominant species in the landed catch at Negombo. However, this species was not recorded at all during the present study. Prematunga *et al.* (1985) and Alling (1985a, b) did not record this species from either Beruwala on the west coast or Trincomalee and Valaichenai on the east coast. *Pseudorca crassidens* and *Steno bredanensis* have both been recorded by Alling (1985a) at Beruwala and in the present study *Pseudorca crassidens* was recorded at Beruwala and Mirissa while *Steno bredanensis* was recorded at Negombo, Beruwala and Mirissa in small numbers. The species *Globicephalus macrorhynca* and *Ziphius cavirostris* recorded by Alling (1985b) at Trincomalee were not encountered in the present study. Joseph and Siddeek (1985) report that *Stenella longirostris* was the dominant species in the catch at Negombo and Beruwala, comprising 40.1% of the catch and Alling (1985a, b) records it as the dominant species in the catch both on the west and east coasts. The present study also confirms that *Stenella longirostris* was the dominant species at all four landing sites, comprising 51.3% of the total recorded catch. Alling (1985b) reported that

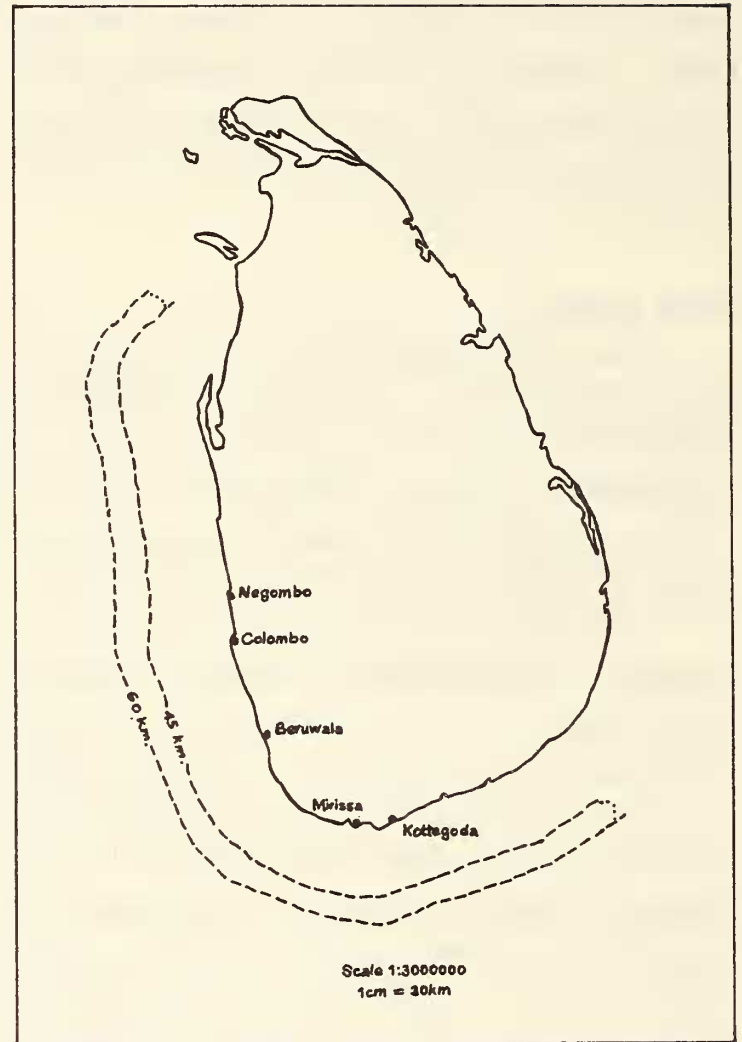


Fig. 3. Map of Sri Lanka showing the study area

Stenella longirostris comprised 34% of total sightings within 48 km off the coast. This could possibly account for the abundance of this species in the catch. However, not enough is known about the population dynamics of small cetaceans in Sri Lanka's waters to reach an accurate conclusion on this at present.

Seasonal variation of the catch in the present study differs from previous studies. Joseph and Siddeek (1985) record that April, May and August had large landings at Negombo and Beruwala. Alling (1985a) records large numbers for Beruwala in June, July and December 1982, November and December 1983, and January, April, and November 1984. In the present study,

there was a consistent increase in numbers landed in September, reaching a peak in October at Negombo, Beruwala and Mirissa. At Kottegoda the peak was in September, declining in October. Fairly high catch rates were also recorded for August and November at all stations. There were slight variations between stations in the seasonal catch of individual species, but in general the peak was always between the end of August and November which was considered as the post-monsoon season in the present study. The only exception was at Kottegoda which had a peak catch of *Stenella coeruleoalba* in April. The only explanation that can be offered at present for the general peak between August and November is that fishing effort is generally highest during the calm season, between the southwest and northeast monsoons. Therefore, bycatch in gillnet operations shows an increase in these months on the southwest coast. In Negombo and Mirissa, where harpooning is practised, this would also be the ideal time of year as harpooning is only possible when the sea is calm. Therefore, the increased catch in September and October is possibly due to the calm sea conditions.

Joseph *et al.* (1983), Joseph and Siddeek (1985), and Alling (1985a, b) have not discussed frequency distribution of body length of different species in relation to the sex ratio. These two sets of data were compared in the present study for the four major species. In *Stenella longirostris* 54.3% of the measured specimens were in the 150 - 179.9 cm range, while 60.1% of these specimens were males and 37.7% were females. Therefore, it can be concluded that a high percentage of adult males are being caught. In *Stenella coeruleoalba* also, the percentage of males caught is 54.9%, and 42.0% of the catch were in the 90 - 119.9 cm range. This indicates a high percentage of juvenile males being caught. The reason for this is not known. High juvenile mortality is a cause for concern as it could have an adverse effect on the recruitment rate of the

population. *Tursiops truncatus* differs from the general pattern by having a higher percentage of females (61.7%) in the total catch, while 46.8% of the total catch is within the 210 - 239.9 cm range. The adult body length for this species is 220 - 400 cm and females are known to reach sexual maturity at 220 - 240 cm (Leatherwood *et al.*, 1982). Therefore, a majority of this species being caught off the south and west coast are breeding females. The pattern for *Stenella attenuata* is very similar to that of *S. longirostris*, with a higher percentage of males (54.4%) being caught, while 32.2% of the total catch is in the 150 - 179.9 cm range.

Of the four fish landing sites chosen for this study, harpooning was practiced only at Negombo and Mirissa. Joseph *et al.* (1983) and Joseph and Siddeek (1985) state that no specimens examined by them either at Negombo or Beruwala were harpooned. In the present study, 44.1% of the catch at Negombo and 66.9% at Mirissa were harpooned. Of the total 366 specimens examined from all four landing sites 30.8% were harpooned. Thus, although harpooning is only practised in a few areas it is a cause for concern. This practice might spread to other areas since the present study found it being done in Negombo where it had not been recorded earlier by Joseph and Siddeek (1985).

More offshore research is necessary to assess the impact of fishery on the population of small cetaceans in Sri Lanka's waters. More information on the population dynamics of the various species is also essential.

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